Harvest Management Working Group

2016 Annual Meeting Report

U.S. FISH AND WILDLIFE SERVICE

$/5

ROSS'S GEESE

S. SHEN (CALIFORNIA)

2016-2017 JUNIOR DUCK STAMP

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PREFACE

This report provides a summary of presentations and discussions that occurred at the 28th meeting of the Harvest Management Working Group (HMWG). The 2016 meeting focused on the work related to the double-loop learning process of Adaptive Harvest Management (AHM), and the challenges of coordinating the revision of AHM frameworks across Flyways. For meeting details please refer to the appended 2016 HMWG Meeting Agenda. The HMWG is grateful for the continuing technical support from the waterfowl management community, including many colleagues from Flyway Technical Sections, the United States Geological Survey (USGS), and other management and research institutions. We acknowledge that information provided by USGS in this report has not received the Director's approval and, as such, is provisional and subject to revision.

ACKNOWLEDGEMENTS

Cover Art: The 2016-2017 Junior Duck Stamp featuring a pair of Ross's geese (*Chen rossii*) drawn by Stacy Shen of Fremont, California.

1 Partner Reports

1.1 Atlantic Flyway (*Min Huang and Greg Balkcom*)

Multi-stock harvest management

Since 2012 the Atlantic Flyway has been working on the development of a decision framework based on the collective status of several representative duck species. This framework will consider the status of five representative duck species (mallard, green-winged teal, wood ducks, ring-necked ducks, and common goldeneye) for determining the general duck season package. These species represent the suite of habitats that the Atlantic Flyway agencies and partners are trying to conserve and protect and are the most important species from a harvest standpoint, comprising over 60% of the annual duck harvest in the Flyway. Our ultimate goal is to integrate habitat management and harvest management objectives into this framework. As we work towards that goal, harvest management based upon the collective status of these representative species is our first step. In advance of implementation of this multi-stock framework we have identified four basic components of the framework; objectives, hypotheses, management actions/alternatives, and outcomes of those alternatives that need to be formally addressed.

With assistance from the USFWS and USGS, we developed a discrete logistic population model for each of the five species. Annual inputs into the model are BPOP and harvest rate. With a working model, we then selected some preliminary regulatory packages and an objective function to begin testing the optimization process. For these trials, we used a simple objective of maximizing harvest over time (although this will not be our true objective).

Along with USFWS and USGS staff we have optimized the annual decision with regards to the representative species. We were pleased to see that it is possible to optimize across five species; however, the initial results are not what we had expected. Going into this, given the observed population trajectories and current harvest policies on all of the species, we thought that we likely wouldn't see any drastic changes to an optimal policy. The initial optimization runs call for a more restrictive harvest regime than we currently have. This is more than likely a result of the estimates of K, which don't seem to be realistic. Our modeling indicates that both mallards and ringnecks are likely at MSY now with our current regulatory package. This, at least for ringnecks, does not seem intuitive nor steeped in reality. We still have much work to do, but we have made great strides and see that we are nearing our goal.

Species specific harvest strategies

The Atlantic Flyway continues to advocate the use of the least number of species-specific harvest strategies. At present and given the current climate with regards to human resources, we would like to see continued effort put into multi-stock management and the other AHM double looping efforts rather than investing those resources into development of more species-specific harvest strategies. With specific reference to the canvasback decision support tool, we are uncomfortable with the current objective of maximizing harvest over the long-term, and we have concerns about the knife-edge of 20,000 birds between a closed season at $< 460,000$ and a liberal 2 season (60/2) at 480,000. We realize that this is a short-term approach for developing canvasback harvest recommendations, and we hope this decision support tool can be improved in the future.

Teal seasons

Florida has requested another year of observation to meet the minimum sample size requirement of the USFWS MOA for hunter performance observations for the Teal Only Days during the Florida Teal/Wood duck season. Apparently, they observed fewer than the required 100 non-target opportunities during their field surveys. The Flyway Council supported this extension, as did the SRC.

Maryland reported on its hunter performance surveys to evaluate the effect of pre-sunrise shooting hours on non-target species during September Teal Season. During the 2013-2016 September teal seasons, Maryland observers collected information on the pre-sunrise portion of 61 hunts. In all, 135 flights of non-target waterfowl species passed within range of hunters with no (0.0%) non-target harvest observed. The attempt rate on these non-target flights was 3.7%, well below the 25% maximum allowable non-target attempt rate. The Flyway Council and the SRC approved pre-sunrise shooting hours for the Maryland September Teal season.

1.2 Mississippi Flyway (*Larry Reynolds and Adam Phelps*)

Discussions of HMWG-related issues by the Mississippi Flyway Council (MFC) and Technical Section (MFCGBTS) took place at both winter and summer 2016 meetings and focused primarily on the Mid-continent Mallard Double-looping process, but also included approval of the HMWG Priority project list, transition in meeting times associated with the SEIS, a framework extension outside of the double-looping process, and the HIP Working Group created by the Association of Fish and Wildlife Agencies (AFWA).

MCM Double Looping Process: Problem Statement and Objectives were worked out and incorporated into a draft progress report. We were working toward filling out a consequence table starting to guide development of new harvest packages and entered the last Flyway meeting with what we thought were 9 points of agreement:

(1) Removal of the NAWMP constraint

(2) 3 Harvest Packages instead of just 2

(3) 1-step constraint depending upon final packages/separation

(4) A formal progress report was needed for reference

(5) Decision on IPM vs Discrete Model set to be made in December

(6) 7 day extension of season length for liberal package but not 14

(7) The starting point for evaluation purposes will be a 3-bird individual bag limit for canvasbacks, northern pintails, redheads, wood ducks, scaup spp., and female mallards. Mottled ducks and American black ducks will have a 1-bird individual bag limit

(8) Mallard bag limit would be same as overall duck limit (6 in CF and 5 in MF)

(9) Jan 31 framework extension

Initial consequence table also included 3 points on the yield curve for mallard harvest and a reduction in the closure threshold from 4.75 million to 3 million. It generated 400 combinations.

But those areas of agreement didn't have as strong agreement as we had thought, and prior to yesterday's meeting, e-mail discussions with Flyway members, mostly Iowa and Michigan, brought the topic of early duck seasons vs September teal seasons and the associated extending of the season length and framework dates back on the table. That was a very big part of yesterday's discussion at a pre-HMWG meeting gathering of the MCM double-looping small group.

We spent most of yesterday's meeting discussing our best professional judgment about the harvest impacts and risk of extending the regular season 16 or 9 days, in September or any time during the framework, extending framework to January 31 and September 1, increasing mallard bag limit to 6 overall and 3 for hens. The goal is still to get an agreed-upon Consequence table to work with at a Joint Flyway meeting planned for June, 2017.

Other Issues:

(1) Timing of USFWS Harvest Recommendations for the fall Flyway meetings: The MFC met August 25-26, 2016, and had to make recommendations to the SRC without the benefit of harvest recommendations from modeling/optimization of the MCM other harvest management strategies. Despite being informed those documents would not be available until September 1, a good-faith effort to find a suitable time for the Council to meet showed late-August was the most feasible time everyone could get together. That has been reaffirmed in subsequent discussions, and the 2017 Flyway meetings are scheduled for August 21-25. The Flyway believes, given these dates are at least 3 weeks later than they were produced in the past, it is reasonable to have those harvest management recommendations prepared by then.

(2) Jan 31 framework extension outside of the Double Looping Process:

There is a desire to extend the framework for the regular duck season to January 31, and it is a high-priority issue for a few MF states. January 31 is already within the current framework, when the last Sunday of the month falls on that date, so this change is not viewed as significant or even warranting vetting through the double-looping process. The SRC disagreed, and the issue is included in the 9 points detailed above. However, some states are continuing to push this issue.

(3) AFWA HIP Working Group:

Since at least 2013, MF states have expressed concern over the estimates coming from the Harvest Information Program, especially those for Active Waterfowl Hunters. For example, Arkansas sells far more state duck stamps (required of all hunters) than HIP hunter estimates, and in both 2013 and 2015, Louisiana lost nearly 30,000 active hunters according to HIP estimates despite level sales of duck hunting licenses and estimates from an independent state survey. With concerns over declining resources allocated for harvest management monitoring data, and increasing use of HIP harvest estimates, there is a need to evaluate and improve the current program. AFWA has created a HIP Working Group that has met at their Philadelphia meeting in September and had a couple of conference call with an initial charge to: Review current HIP procedures at both state and federal levels and make recommendations about improving sample frames, modernizing survey design, specifying objectives, and controlling costs. MF considers this a priority.

1.3   Central Flyway (*Mark Vrtiska and Mike Szymanski*)

The primary issue and work item for the Central Flyway that affect decisions for future regulatory cycles centers on the double-looping process for mid-continent mallard adaptive harvest management (MCM AHM). We believe additional progress has been made on MCM AHM this past year, working in conjunction with the representatives from the Mississippi Flyway and U.S. Fish and Wildlife Service (Service). Considerable work remains, and the Central Flyway looks forward to moving ahead with MCM AHM revisions, particularly as they may affect overall duck harvest management. Further progress will be made, but recognize that some difficult decisions are ahead as we consider various packages and attempt to align our decisions with results from the Stakeholder Survey. Additionally, we still support the emerging sub-objective of "reducing the overhead" associated with the regulatory process (i.e., staff time devoted to technical analyses that need to be performed on an annual basis as part of the regulatory process). While most on the HMWG agree that the process could be simpler, discussions seem to end "technically heavy" with an unwillingness to move into a management paradigm built off previous AHM experience that uses basic decision making processes that could be understood by most constituents.

The Central Flyway remains, and is becoming increasingly concerned about the Service's commitment and resources available to various programs associated with migratory bird management, particularly game birds. We have had numerous examples of diminishing priority, commitment and resources toward cooperative management of trust species, putting unsustainable workloads on both Service and state personnel. This management paradigm cannot be sustained without irreparable damage or major changes

to the Service's ability promulgate, implement, and update harvest strategies and regulations, which ultimately will affect state agencies and hunters. Undoubtedly, the Service's lack of commitment will undermine abilities of states to garner cooperative support and effort to collectively manage migratory birds.

Finally, previously expressed concerns from prior HMWG meetings still remain. Primarily, we see waterfowl hunter R3 activities, issues relating to banding programs, and Canada and light goose issues as top priorities. It should be noted that these are the opinions and perceptions of the Central Flyway's HMWG representatives, both long-term members of the Central Flyway, and that this statement has not been reviewed or approved by the Central Flyway.

1.4 Pacific Flyway (*Jeff Knetter and Brandon Reishus*)

The Pacific Flyway Study Committee (PFSC) and Pacific Flyway Council (PFC) reviewed HMWG priorities at the early-and late-season regulations meetings in 2016. The PFC endorsed the following 2017 priority rankings and project leads for the technical work proposed at the 2015 Harvest Management Working Group (HMWG) meeting:

Highest Priorities (Urgent and Important)

- Mallard AHM Revisions (aka, Double-looping)
    - Multi-stock management (Atlantic Flyway, PHAB, HMWG).
    - Mid-continent mallard (Mississippi and Central Flyways, PHAB, others...).
    - Western mallard (Pacific Flyway, PHAB, others...).
    - Consideration of NAWMP objectives for waterfowl management (HDWG, Flyway Councils, FWS, NAWMP Interim Integration Committee, Joint Technical Committee, others...)
- Re-invigorate institutional support for AHM (PHAB and HMWG Communications Team)

Long-range Priorities (Non-urgent but very important)

- Time dependent optimal solutions to address system change (Scott Boomer, Fred Johnson, Mike Runge).
    - Habitat change
    - Hunter dynamics
    - Climate change
- Northern pintail AHM Revision (Double-looping) (Pacific Flyway, PHAB, others...).

Additional Priorities

- Waterfowl harvest potential assessment methods case study development (PHAB, Tech Sections, others).
- 2017 Canvasback harvest strategy development (PHAB, Tech Sections, others..).

Council acknowledges a revised approach was necessary to address the technical challenges associated with implementation of the preferred alternative specified in the Final SEIS. In addition to this highest priority, each of the priorities identified by the Pacific Flyway (i.e., Western Mallard Model updates, pintail model updates) are included in the HMWG priorities.

Western mallard model

Council appreciates the work done by the Service during 2015 and 2016 to revisit the Western Mallard Model (WMM), developed during 2008, and include other breeding and harvest areas important to the Pacific Flyway (British Columbia and Washington). The WMM was initiated to set framework dates and regulatory packages for mallards in the Pacific Flyway; however, since its inception in 2008, only California, Oregon, and the Alaska-Yukon breeding populations were used in the population model. Beginning with the 2017 regulatory cycle, the model now includes estimates from British Columbia and Washington. Council continues to pursue improvements to the model such as the addition of data from other important areas of the flyway. Currently, only banding data from the states that conduct breeding surveys are incorporated in the model; however, states like Idaho and Nevada have ongoing operational preseason banding programs. Additionally, Nevada has been conducting a revised aerial breeding survey since 2009 and is investigating ways to retroactively correct estimates from older surveys. We are working with the Service to explore incorporating these data into the WMM.

Northern pintail

In 2010, the PFSC recommended a pintail harvest strategy to include an option of a liberal bag limit of 3 in the recently adopted derived strategy. Council compromised with other flyways for a maximum limit of 2, which was adopted by the Service. The breeding populations of northern pintails were estimated at approximately 4.4 million in 2011, 3.5 million in 2012, 3.3 million in 2013, 3.2 million in 2014, and 3.0 million in 2015. Pintails have increased at least 67% in recent years from the low of 1.8 million in 2002. Based upon current population estimates, Council would like to reopen discussion about increasing pintail harvest opportunities at higher population levels.

Harvest strategies of northern pintails continue to be a high priority for the Pacific Flyway. Council continues to support efforts to develop harvest strategies and refine the population model to meet both biological and human dimension goals. Additionally, Council supports future technical developments with the current pintail model that may include updated information on parameter estimates used in this model and possible increased bag limits in the harvest packages.

The Pacific Flyway supports reviewing the pintail harvest strategy models in an effort to develop a revised harvest strategy that will allow for a 3-bird bag limit when populations are high while simultaneously: 1) balancing objectives across all four flyways, 2) minimizing closed seasons, 3) eliminating partial seasons and seasons within seasons, 4) minimizing regulation changes, and 5) maximizing a greater than 1 bird limit and full seasons.

1.5   Canadian Wildlife Service (*Christian Roy*)

Modernization of Migratory Birds Regulations   CWS continues to make progress on the modernization of Canada's Migratory birds Regulations to improve the management of hunting in Canada and correct references to Indigenous people in Canada. The new Regulations are currently being drafted by the Department of Justice Canada. The new regulations will be published in the Canada Gazette for public consultations before finalization and coming into force. The implementation targeted date is fall 2018.

Consultation on National Baiting policy   CWS held public consultations in February 2017 on proposed changes related to baiting and hunting of migratory game birds. The CWS' proposals are to stop issuing bait authorizations, and prohibit the intentional modification of agricultural crop fields in order to attract birds for hunting. These consultations are a continuation of the revision process of the Migratory Birds Regulations initiated in 2014.

Canadian Harvest Survey Review   A review of the CWS harvest surveys has been initiated in 2015 to: 1) revisit the survey objectives and evaluate current data needs and gaps, and 2) modernize the survey methodologies, given the new electronic permitting system. A harvest survey working group has been formed to lead the review. There will be ongoing engagement of partners as the review proceeds.

Migratory Game Birds Banding Needs Assessment   CWS has established a working group to complete a banding needs assessment for all duck species. The first step of the review was to assess the current budget and time allocated to these projects. The next step will be to assess our needs and the current gaps in our banding strategy. It is still possible that we will extend the review to geese and other harvested species in the future.

Estimating Detection in Helicopter Surveys   During the last few years the CWS biologists have worked on developing a double dependent observer method to estimates detection during their annual helicopter surveys. The CSW hope to revise the field operating procedure for helicopter survey in the near future and use the double dependent observer method in the Eastern waterfowl surveys and other sampling protocol in the future.

1.6   Communication team update (*Jim Kelley*)

For 2015–2016, the Communication team coordinated efforts to provide materials describing the SEIS2013 implementation as well as the need for continued institutional support of AHM. These products included a Q and A white paper and AHM presentations for Flyway councils. The communication team recognizes that several actions were not accomplished, including updating AHM 101 videos, the development of a web-based information hub, and an infographic illustrating the new regulatory schedule and process. Communication issues for 2017 will focus on the revision of the communication plan and reinforcing the institutional support for AHM through the double-loop learning process.

2   New business

2.1   Waterfowl breeding and habitat survey review (*Christian Roy*)

The USFWS and the CWS have initiated a comprehensive review of the Waterfowl Breeding Population and Habitat Survey (WBPHS). This review should include a careful consideration of primary uses of WBPHS data, management and survey objectives, and the integration of the survey with other waterfowl monitoring efforts. The review will provide guidance and recommendations for changes to the WBPHS design, operations, and analyses, as well as develop processes for ongoing survey oversight and review. The review committee will be led by biologists from the UFWS and the CWS. The review committee is currently working on drafting the review proposal and timeline which will be shared with the broader waterfowl community and the USFWS and CWS leadership for review.

3   Partner Updates

3.1   NAWMP 2012 revision and PET updates (*Dave Case*)

The theme of the 2012 NAWMP Revision and associated Action Plan was "People Conserving Waterfowl and Wetlands." This revision was different in a number of important ways. First, it was the first "revision"

since the original plan in 1986. Other changes over the years were considered "updates." Second, it highlighted the imperative to focus on people. And third, it acknowledged the strong linkages among goals-as an integrated management system.

Public Engagement Team Update   The Action Plan included seven recommendations that have been the framework for implementation since the 2012 Revision was released. Recommendation 5 said, "Build support for waterfowl conservation by reconnecting people with nature through waterfowl, and by highlighting the environmental benefits associated with waterfowl habitat conservation." Toward that end a Public Engagement Team (PET) was stood up. The PET has worked closely with the Human Dimensions Working Group (HDWG; Recommendation 4) since both were put in place.

The PET/HDWG developed a public engagement strategy that identified three priorities for which Action Plans should be developed:

Action 1: Further develop and implement the 2008 Waterfowl Hunter Recruitment and Retention Strategy (Chair, Andy Raedeke, Missouri Department of Conservation) Action 2: Engage the viewing communities and other conservation interested publics in actions that contribute to the NAWMP goals and objectives (Chair, Jennie Duberstein, Sonoran Joint Venture) Action 3: Increase landowner participation in conservation programs (Chair, Dave Smith, Intermountain West Joint Venture)

Progress has been made on all three priorities (see separate reports in this document).

2018 NAWMP Update   —

Believe or not, it's time to update the North American Waterfowl Management Plan (NAWMP) 2012 Revision. An Update Steering Committee with Co-chairs from Canada, U.S., and Mexico has been formed and an initial presentation to Plan Committee has been made regarding the process for the update.

An assessment of the 2012 Revision and its implementation will be conducted to inform the 2018 Update and will include:

- A review and summary of documents and reports

- A survey of the waterfowl management community (in addition to the results from the hunter, viewer and general public stakeholder surveys)

- The Future of Waterfowl Management II Workshop (FoW2) to be held the week of Sept. 25th at NCTC

A writing team will be appointed to complete the Update following the FoW2 Workshop.

3.2   Human dimensions working group (*Mark Vrtiska*)

The primary focus of the Human Dimensions Work Group (HDWG) in 2016 has been the compilation, design, and implementation of the 3 stakeholder surveys (i.e., general public, waterfowl hunter, and bird viewer). The sampling frame for the general public survey was going to follow that of the National Fish and Wildlife Survey conducted by the U.S. Fish and Wildlife Service. The waterfowl hunter survey was going to be derived from the Harvest Information Program (HIP) registrants from each state and use all those individuals who had hunted waterfowl (i.e., indicated they had hunted either ducks or geese). Finally, the member database from e-Bird was going to be used given the large number of registrants in this database and the lack of sufficient members in some state-level ornithological groups. There were several iterations of the survey instruments after meetings with the individual flyways, other meetings, and conference calls.

The hunter and viewer surveys went out in late October/early November. Initial responses to the viewer survey were considerable. Initial response rate for the hunter survey was below expectations.

Activity has also been occurring with the Public Engagement Team (PET), and more specifically, development and implementation of the action plans for the 3 task groups (Landowner, Viewer and Hunter Groups) that have been formed under the PET/HDWG. In the Hunter Task Group, each flyway has had meetings with state hunter recruitment, retention and reactivation personnel to discuss waterfowl hunter numbers and participation efforts (see Hunter retention, recruitment, reactivation workshop results section).

Another major topic within the HDWG is lack of an appropriate chairperson. Andy Raedeke, Missouri Department of Conservation, has been filling that role since the departure of Cal Dubrock. While Andy has been doing an admirable job, it is recognized that attendance at larger, national and regional meetings and connections at higher level administrative levels are needed. Suitable candidates are typically already heavily engaged in other activities.

3.3   Hunter retention, recruitment, reactivation workshop results (*Andy Raedeke*)

The HDWG and PET have formed a task group to further develop and implement the 2008 Waterfowl Hunter Recruitment and Retention Strategy. The four flyway Human Dimensions Committee chairs are leading this effort. They have aligned waterfowl hunter recruitment, retention, and reactivation (R3) efforts with national hunting and shooting sports R3 activities. The Council to Advance Hunting and Shooting Sports in cooperation with the Wildlife Management Institute recently released a National Hunting and Shooting Sports Action Plan. This past year, all four flyways held workshops to engage the waterfowl management community in waterfowl hunter R3. The workshops were conducted collaboratively between the Wildlife Management Institute (WMI), the Council to Advance Hunting and the Shooting Sports (CAHSS) and the individual flyways. The workshops were designed by Matt Dunfee (WMI) and Andy Raedeke. Matt Dunfee or Samantha Pedder (CAHSS) led each of the workshops. Dave Case (DJ Case & Associates) facilitated the Mississippi, Pacific and Atlantic Flyway workshops and prepared this summary document. Workshop presentations and other workshop materials that flyway members would like to use for state-led efforts may be obtained from DJ Case & Associates.

Workshops focused on highlighting the need to address waterfowl hunter R3. Although we have observed record numbers of waterfowl in recent years, waterfowl hunter numbers have not responded in kind. It is uncertain how hunting participation trends may change in response to declining waterfowl populations. Moreover, the waterfowl hunter population is aging. As baby boomers age, we potentially could witness a more rapid decline in hunter numbers unless we see a higher rate of recruitment among other age cohorts. One of the dangers of losing waterfowl hunters is that it also likely would translate into a loss of support for wetland and waterfowl conservation whether it is through the management of privately owned wetlands, financial contributions, or political support for conservation policy.

The Flyway HD chairs surveyed states to identify current R3 activities. Results indicated that states are extensively involved in a variety of R3 and waterfowl R3 activities including outreach, communication, hunt program management, and license sales strategies. However, very few states indicated that they were using a planning framework that included objectives, strategic approaches to identify best management practices, and monitoring. At the workshops, we proposed updating the 2008 Waterfowl Hunter Recruitment and Retention Strategy under the umbrella of the National Hunting and Shooting Sports Action Plan. The intent is to develop a coordinated, structured approach to waterfowl hunter R3 that takes advantage of the culture of coordination and structured decision making already present in the waterfowl management community. States expressed interest in participating in further developing and implementing this approach.

3.4 USFWS Migratory Bird Program priorities and administration transition (*Jim Dubovsky*)

The USFWS's Migratory Bird Leadership Team (MBLT) met in October 2016 to discuss priorities for the Program. The MLBT consists of the Assistant Director and Deputy Assistant Director for Migratory Birds, the chiefs of the Division of Migratory Bird Management (DMBM) and the Division of Bird Habitat Conservation (DBHC), the Assistant Regional Directors for Migratory Birds or the Regional Migratory Bird Chiefs, and DMBM and DBHC Branch Chiefs. The exercise was to fulfill two functions: (1) provide priorities to the incoming administration's transition team, and (2) begin work toward revising the strategic plan (i.e., "Blueprint" document) previously used to guide Migratory Bird Program activities from 2004-2014. Initially, the MBLT brainstormed potential priority issues that might be forwarded to the transition team. The group then selected the following set of priorities to further develop into a document for the transition team:

(1) Engage appropriators and administrators to increase awareness of the Migratory Bird Program

(2) Advance technological investments and improvements for the Program

(3) Enhance partnership-based conservation

(4) Conserving birds throughout their annual cycle

(5) Assessing data needs based on risk tolerance

(6) Develop/improve informed management for all types of take (e.g., hunting, permits, etc.)

MBLT members were assigned to breakout groups for each of these issues, and were tasked with developing specific, deliverable products for each. The Program would focus resources on those issues, including trying to garner additional resources and/or redirecting current resources to complete the products. Although the near-term task was to develop a short document for the transition team, these and other issues will be developed into a revised guidance document for the Migratory Bird Program for the coming years. That larger effort has not yet been initiated, and will include input from additional stakeholders. Over the next several months, stakeholders will be contacted to provide ideas and submit feedback. The goal is to have the guidance document completed during the summer of 2017.

3.5 AHM resiliency and institutional support (*Scott Boomer*)

The HMWG discussed the loss of technical positions in the Population and Habitat Assessment Branch in relation to the shifting priorities of the Division of Migratory Birds. Given the uncertainty with the new administration, we recognized that the back-filling of vacant positions would be delayed. In addition, the working group discussed opportunities to communicate the loss of technical capacity and the monitoring resources necessary for AHM to our partners within the evolving HMWG communication strategy. We finished with a round-table discussion focusing on the relevancy of harvest management within the broader waterfowl management community.

4 Mid-continent mallard AHM revision

4.1 Progress report (*Adam Phelps*)

A subgroup of the Mississippi and Central Flyway technical sections and representatives from the U.S. Fish and Wildlife Service (FWS) met in June 2016 in Kansas City, MO and continued discussions on revisions to

mid-continent mallard adaptive harvest management (MCM-AHM). The group continues to work with the following objective and goals:

Objective: The goal of mid-continent duck harvest management is sustainable duck populations, maximizing long-term hunting opportunity while minimizing regulatory change. This goal addresses the following points:

- Maintain hunter numbers and effort at or above the 1999-2014 average.

- Maintain duck populations sufficient to sustain hunting opportunity.

- Implement policies and regulatory processes that are less resource intensive

At this meeting, nine points of agreement were reached to move forward.

(1) Removal of the NAWMP constraint from the mid-continent mallard AHM objective function.

(2) Three different regulatory options need to be included in the evaluation process, not just two.

(3) A one-step constraint may be important in the event that a protocol with 3 regulatory options is used. This will be dependent on what the packages look like, as well as dependent on the results of the simulations and the separation between packages.

(4) A formal progress report needs to be prepared.

(5) A decision on whether to recommend using a discrete model set versus an integrated population model will be made at the December 2016 HMWG meeting.

(6) A 7 day season expansion will be evaluated and a 14 day season expansion will not.

(7) The starting point for evaluation purposes will be a 3-bird individual bag limit for canvasbacks, northern pintails, redheads, wood ducks, scaup spp., and female mallards. Mottled ducks and American black ducks will have a 1-bird individual bag limit.

(8) For evaluation purposes, the bag limit for mallards should be the same as the overall duck bag limit (6 CF / 5 MF, with dissent from Larry and possible dissent from MF).

(9) Evaluation of a duck season ending framework date of 31 January is acceptable.

As these points of internal agreement were discussed with the two Flyways, it became clear that several states were uncomfortable with these points of agreement. For instance, several states in the Mississippi Flyway were very interested in what 14 day season extensions might look like, and few if any were interested in a duck bag of 5.

These concerns were addressed at a meeting the day before the Harvest Management Working Group convened. At this time, a potential liberal package was designed that included all the most liberal possibilities on the table. This will act as a starting point for any evaluations of potential impacts to harvest rates.

The group is comfortable with the prospect of using an integrated population model (IPM) in lieu of the discrete model set that has been used in AHM to this point. The group's current work is focusing on development of potential packages (liberal, moderate, and restrictive options, in consultation with the Flyways) to be simulated through the IPM.

How the revised AHM process handles species for which there are current harvest restrictions and/or strategies in place is a crucial part of the process. In order to reduce this to a series of more tractable problems, the group is dealing with mallards first. The other species will be folded in once we have predictions for harvest rates for mallards under any potential new harvest regimes.

Finally, a consequence table is under development. This tool will allow the two Flyways to weigh the interactions of all the various components of duck harvest management to reduce the pool of potential management actions considered. We plan to use this consequence table to guide a swing weighting exercise during a joint meeting of the Flyway technical sections in June 2017. The June consequence table will be preliminary, but we believe that the results from this exercise will be crucial in allowing us to reduce the number of alternatives we need to consider in the final evaluation steps. These preliminary results can then be used for a final swing-weighting exercise at the winter Flyway meetings in 2018.

Implementation of the revised mid-continent AHM process is tentatively planned for the 2019-20 hunting season (to be in place by fall of 2018).

4.2 Mid-continent mallard model development: progress report (*Scott Boomer*)

We presented some preliminary results describing our efforts to update the mid-continent mallard modeling framework to support AHM. Estimation frameworks were developed to 1) update the current parameterization of the the discrete model set that was established in 2002 (Runge et al. 2002) based on updated data from 1974–2015, and 2) estimate mallard demographic and population estimates with an integrated population model (IPM; Schaub and Abadi 2011). In general, the equilibrium analyses based on updated parameter estimates resulted in slightly larger carrying capacity values and equilibrium population sizes, suggesting that the harvest capacity of mallards has increased. We developed an IPM for mid-continent mallards with sub-models similar to the recruitment and survival sub-models developed for black ducks (Conroy 2010). The mid-continent mallard double-looping technical team suggested that we move forward with the development of an IPM for mid-continent mallards, recognizing that there are several issues that need to be addressed. These include:

- Are we comfortable using the same balance equation moving forward?

- Have we captured the key relationships in our modeling (e.g., state dynamics, functional forms)?

- Have we adequately addressed system change?

- Have we identified the key sources of structural uncertainty that limit our ability to manage?

5 Eastern mallard AHM revision

5.1 Progress report (*Min Huang*)

Since 2012 the Atlantic Flyway has been working on the development of a decision framework based on the collective status of several representative duck species. This framework will consider the status of five representative duck species (mallard, green-winged teal, wood ducks, ring-necked ducks, and common goldeneye) for determining the general duck season package. These species represent the suite of habitats that the Atlantic Flyway agencies and partners are trying to conserve and protect and are the most important species from a harvest standpoint, comprising over 60% of the annual duck harvest in the Flyway. Our ultimate goal is to integrate habitat management and harvest management objectives into this framework. As we work towards that goal, harvest management based upon the collective status of these representative species is our first step. In advance of implementation of this multi-stock framework we have identified four basic components of the framework; objectives, hypotheses, management actions/alternatives, and outcomes of those alternatives that need to be formally addressed.

The two objectives for duck harvest management in the Atlantic Flyway are; (1), Sustain Atlantic Flyway duck populations at levels that meet the legal mandates and demands for the recreational uses of this resource and (2), Maximize hunter satisfaction with harvest opportunity and regulations. Towards that end,

a suite of management alternatives (regulatory packages) and their outcomes (harvest rates, resulting BPOP's) have been estimated.

With assistance from the USFWS and USGS, we developed a discrete logistic population model for each of the five species. Annual inputs into the model are BPOP and harvest rate. The first input comes from the annual estimates of BPOP using the integrated survey data from the entirety of the Eastern Survey area (strata 51-54, 56, 62-72) and the US Plot Survey area. The second input, the measure of harvest has changed since we began. Initially we were using the absolute harvest as the input into the model. This was not satisfactory as there were issues with parsing out Canadian harvest and for some species such as AGWT, harvest estimates were half of BPOP estimates. This was not congruent with the recent teal harvest assessment and did not make sense. This led us to believe that there was a bias in one of the two data streams. We then decided to use harvest rates based on band recovery data as the input. The use of harvest rate as the response variable enables us to better deal with any bias in the BPOP survey or harvest survey estimates. The time series we are using spans 1998 to present. With a working model, we then selected some preliminary regulatory packages and an objective function to begin testing the optimization process. For these trials, we used a simple objective of maximizing harvest over time (although this will not be our true objective). We feel that a shoulder strategy best represents the desires of the Flyway, however, for the initial simulations, we are going with maximizing harvest.

Along with USFWS and USGS staff we have optimized the annual decision with regards to the representative species. We were pleased to see that it is possible to optimize across five species, however, the initial results are not what we had expected. Going into this, given the observed population trajectories and current harvest policies on all of the species, we thought that we likely wouldn't see any drastic changes to an optimal policy. The initial optimization runs call for a more restrictive harvest regime than we currently have. This is more than likely a result of the estimates of K, which don't seem to be realistic. Our modeling indicates that both mallards and ringnecks are likely at MSY now with our current regulatory package. This, at least for ringnecks, does not seem intuitive nor steeped in reality.

The Flyway has had a discussion about how to best integrate human dimensions into the decision framework and at what scale that integration might be appropriate. It would seem that true integration of harvest, habitat, and human dimensions may really only occur at the state and local scale, not at the Flyway or National scale, as may have been originally envisioned by the 2012 NAWMP Revision. At the Flyway scale, however, human dimensions play an integral role in informing our harvest management objectives. Human dimensions also frame our regulatory packages. We feel that at this time there was likely no need to conduct any further survey work to inform potential regulatory package changes. If we decide that recruitment is part of our measure of satisfaction, then we will likely need to frame the right questions and target current non hunters to answer those questions. Currently we have identified the percentage of repeat and occasional hunters and hunter age structure as measures of satisfaction amongst our constituent base.

We still have much work to do, but we have made great strides and see that we are nearing our goal.

5.2 AHM of multiple duck species in the Atlantic Flyway (*Fred Johnson*)

Five duck species were chosen as representative of hunting opportunity and wetland habitats: mallard, American green-winged teal, wood duck, ring-necked duck, and common goldeneye. We assumed logistic growth, with harvest occurring after population growth, and used a state-space approach to fit the parameters of the logistic model using Bayesian methods. We relied on band-recovery data to estimate current harvest rates, and then used the parts-collection survey to estimate the proportional reduction in harvest of each species that was expected from shorter seasons and smaller bag limits. We specified a restrictive season of 30 days and a 3-bird bag, a moderate season of 40 days and a 4-bird bag, and a liberal season of 60 days and a 6-bird bag. We used stochastic dynamic programming to calculate optimal regulatory policies that would maximize aggregate duck harvest over an infinite time horizon - using both equal and unequal weights for the 5 species. We then simulated the use of these policies to derive expected performance. Optimal policies tended to be surprisingly conservative. This appears to be because the

mallard harvest rate for the moderate regulation matches quite well the harvest rate for maximum sustained yield and, being the most abundant of the five species, mallards contribute a large share (44%) of the aggregate harvest. The inclusion of model error for all five species in the aggregate policy also led to more conservativism. However, caution is warranted in the interpretation of results as the estimation of the intrinsic growth rate was problematic, with posterior estimates hardly distinguishable from priors. The observed populations are close to estimated carrying capacity and this strains credibility, in that all species have been subject to relatively liberal hunting regulations. Finally, regulation-specific harvest rates are also based on critical assumptions that cannot be verified. In general, the success of state-space modeling was limited by lack of contrast in the time series of population sizes and harvest rates. Yet our analyses provide a proof of concept, in that an optimal harvest policy that explicitly considers multiple species can be derived (rather than prescribed ad hoc). The framework can now be used to investigate alternative objective functions, regulatory frameworks, and/or parameters of the population models.

6   Pacific Flyway AHM Issues

6.1   Western mallard breeding population (*Jeff Knetter and Josh Dooley*)

From 2008-2015, western mallard adaptive harvest management (AHM) considered mallards breeding in Alaska (AK), and mallards breeding in California and Oregon (CA-OR) as two separate stocks. In 2016 breeding mallards from Washington and British Columbia were added to the CA-OR stock (hereafter the 'southern' stock). The Pacific Flyway is also interested in including mallards breeding in Nevada to the southern stock, so NV revised their breeding survey in 2009 to a transect-based survey to obtain a more reliable index to the breeding population in the state. Nevada breeding mallard population size averaged approximately 7500 per year between 2009 and 2016. Idaho does not have an aerial breeding survey for waterfowl, but has an extensive pre-hunting season banding program and is interesting in including ID banding data to western mallard AHM. We presented an assessment comparing western mallard AHM with and without NV breeding population and banding data, and Idaho banding data in western mallard AHM. Including the NV and ID banding data resulted in only a minor increase in annual harvest rates and no change in expected harvest rate distributions for the southern stock of western mallards. We imputed breeding population estimates for NV from 1992 to 2008 using the same approach as applied to WA and BC breeding population data (i.e., sampled estimates from the mean and variance of the observed data during updating within the Markov Chain Monte Carlo process). Including the NV breeding population data and the updated annual harvest rates increased estimates of $rmax$ and the scaling parameters derived from the discrete logistic model. However, it was not clear whether these changes were meaningful given the relatively large uncertainty around these parameter estimates. Consequently, the revised parameters and expected harvest rate distributions had little effect on the overall policy for western mallard AHM. This assessment was considered preliminary because a USFWS statistician is currently conducting a final review of the design for the NV breeding population data. Once that review is complete, we will re-run the assessment with any changes in the NV time series and present the final results at the Pacific Flyway meeting in late February, 2017.

7   Group Discussion: what happens with pintails, scaup, and canvasbacks

The HMWG discussed how changes in mallard decision frameworks may impact current national AHM frameworks for pintails and scaup and the canvasback harvest management decision tool.

7.1 Multi-criteria decision analysis: methods & applications for AHM (*Mike Runge*)

Specifying an objective function for waterfowl harvest management is difficult, in part because our goals are multifaceted. Even the current objective function for mid-continent mallards is a combination of at least four objectives: maximize harvest, keep mallards around for the indefinite future, aim to achieve the North American Waterfowl Management Plan goal of 8.8 million; and provide the opportunity to hunt any time the population size is greater than 5.5 million. We've tinkered with this a bit over the years, exploring other elements, like one-step constraints. Starting in about 2004, we started looking at "shoulder strategies"as a way of formulating the objective function that sought an equilibrium point on the right shoulder of the yield curve, rather than at the peak of the yield curve. Interestingly, as we've explored shoulder strategies for mallards, pintails, and other species, folks always ask:

> "OK...if you're going to run that strategy, tell me... how often will the season be liberal, how often will it be closed, how often will we have season-within-a-season, how often will we skip steps in the packages, will we ever have 2 birds in the bag again?"

As it turns out, these questions relate directly to many of the harvest management objectives we care about. For years, we've treated AHM (and related strategies) as single-objective problems, but at the core, these are multiple-objective problems because we are trying to manage trade-offs among the objectives of many stakeholders. Until around 2010, we did not have the language or framework to discuss those multiple objectives clearly, but that changed with the effort to evaluate the pintail strategy, and the double-looping efforts for mid-continent mallards reflect the desire to acknowledge the multiple objectives in these strategies.

Multi-criteria Decision Analysis (MCDA) is one of the many branches of decision theory. It deals with the class of problems in which the challenge to the decision maker is managing trade-offs among multiple objectives. There's a massive literature on the theory and practice of MCDA. In recent years, there have been dozens of applications of MCDA to problems in natural resource management, and perhaps this should come as no surprise-our most challenging issues require us to carefully balance the desires of many diverse stakeholders. Many of the elements of a multi-criteria decision analysis are familiar in the AHM world: a clear statement of objectives, with quantitative attributes that can be used to measure them; a set of alternative management actions (or strategies) to choose from; and a way to describe the consequences of the alternatives in terms of the objectives, in our case in the form of predictive models. The field of decision theory then offers some tools for *solving* MCDA problems, the most common of which are direct trade-off methods (like the Simple Multi-attribute Rating Technique, SMART). The gist of these methods is to elicit the values from a decision maker, or from stakeholders, regarding how much they care for the different objectives relative to one another; how much would they trade one objective for a gain in another? Swing weighting is a common method for this values elicitation. The important thing is that we recognize that the relative weighting of the objectives is a values judgment, not a scientific judgment, as it reflects how humans care about the various outcomes.

In 2010, we used an MCDA process to evaluate 81 alternative pintail harvest management strategies. These alternatives differed in the shoulder point they sought, in the packages they allowed, in their treatment of a closure threshold, and in whether they allowed a partial season. We evaluated those alternative strategies against 8 objectives: the average BPOP, the average harvest, the frequency of closed seasons, the frequency of partial seasons, and the frequency of L1, L2, L3, or L5/7 seasons. We asked each of the flyways to conduct a swing-weighting exercise to place relative weight on those different outcomes, and we ranked all the strategies based on how well they maximized the weighed outcome. The Flyways agreed to, and the Service Regulations Committee implemented, one of the top ranked alternatives. That is, we were able to develop a harvest strategy by using a formal MCDA process, with the dynamic optimization embedded in the alternatives.

Some of the ongoing double-looping processes for the mallard stocks may want to use MCDA methods, perhaps in a manner similar to the pintail strategy. It could also be possible to consider the use of MCDA

methods for exploring multi-stock optimization. The key step that opens up the possible use of these tools is the recognition that multiple objectives are at play.

7.2 Proposed options for coping with multi-stock issues across Flyways (*Mike Runge*)

Flyway-specific conditional process. Flyways independently explore their mallard (or joint) strategies, and evaluate the effect on special species by assuming (a) that the current special strategies remain the same, and (b) the other flyways don't change what they do. Work out what their best strategy would be. Then you'd have to come together to make sure it all fit together. You'd probably implement the mallard strategies, then conduct a double-loop exercise on the special strategies.

Flyway-specific joint strategies. All flyways consider multi-stock strategies; they might focus on just mallards to drive, say season length, but they would have strategies that absorbed the special strategies and built them into their regulations. Evaluate effects on main species and consider trade-offs from the individual flyway perspectives. Identify preferred alternatives for each flyway, then explore the impacts when they're all put together.

Two-phase national joint strategy. Flyways develop small set of flyway-specific options they'd like to consider (perhaps by going through a larger set of options, tradeoff analysis, then narrow the set). Then we run all combinations of the individual flyway options to predict outcomes across array of objectives. Do a trade-off analysis across flyways to develop the national strategy. Perhaps two ways to structure: a. Mallard seasons with special species considerations. Would probably need a small set of national special species options to consider. b. Flyway options begin as multi-stock options (that absorb the special species)

National multi-stock fixed strategy. Imagine a fixed (not dynamic strategy), with flyway-specific bags and lengths. We can simulate this for a handful of species (mallard, pintail, canvasback, scaup, and teal). Two ways to develop a. Back into it from equilibrium dynamics; figure out the desired harvest rates for each species, craft packages that are expected to achieve that b. Build a gaming system and allow people to explore all the strategies they want to cook up.

The HMWG explored the feasibility of these options with the Mid-continent mallard double-looping technical team and discussed moving forward along the lines of the first option (Flyway-specific conditional process).

8 Progress reports and updates

8.1 Integrated population models (IPM) as a basis for harvest management (*Scott Boomer*)

The United States Fish and Wildlife Service coordinates an Adaptive Harvest Management (AHM) Program to inform annual waterfowl harvest regulations at the Flyway scale. The adaptive management process requires population models to predict population responses to exploitation while accounting for multiple forms of uncertainty and environmental variation. Under AHM protocols, population models are used in an optimization procedure to determine optimal harvest regulatory decisions relative to harvest management objectives. The first AHM protocols developed for mid-continent mallards (*Anas platyrhynchus*, 1995) and eastern mallards (2000) used different parametrizations of a population model to represent structural uncertainty about the factors that govern their population dynamics. These models were developed with survival and recruitment parameters resulting from piecemeal, independent analyses. In contrast, recently implemented AHM decision frameworks for American black duck (*A. rubripes*), western mallard, and scaup (*Aythya affinis, A. marila*) are based on population parameters and process variance estimates from

integrated estimation frameworks that evaluate multiple data sources. As these population parameters are updated each year based on information from monitoring programs, parametric uncertainty is reduced and future regulatory decisions are based on the most recent information. We describe how these estimation methods and results are used in current decision making protocols and discuss how these tools may be used in the future to develop revised population models for other mallard AHM frameworks.

8.2   IPM to evaluate factors affecting mid-continent mallard recruitment and survival (*Qing Zhao*)

Integrated population modeling is increasingly used to incorporate demographic information in population models because they correctly account for uncertainty, improve the precision of parameter estimates, and allow for the estimation of some parameters without specific data. In our example, we applied an integrated population modeling approach to 40 years of band-recovery, parts collection, and population survey data for the mid-continent mallard population, along with covariate information consisting of wetland habitat (ponds), climate data, and Conservation Reserve Program (CRP) information. We examined the effects of climate, habitat, and harvest management on Mallard demography and population dynamics. The integrated population model, analyzed within a Bayesian hierarchical framework, revealed that ponds had a positive effect on mallard reproduction after accounting for density dependence processes. The model also revealed that ponds had a negative effect on the non-hunting survival of adult females, possibly due to the life history trade-offs between reproduction and survival of adult females. Because pond dynamics were strongly influenced by climate (positive effect of precipitation and negative effect of temperature), the carrying capacity of the mid-continent mallard population was forecasted to decrease under future warming scenarios. On the other hand, CRP seemed to only have a weak effect on pond dynamics, probably due to the limited spatial extent we considered. Future studies should examine the effect of predators on mallard survival, consider life history trade-offs and habitat conservation at larger spatial extents.

8.3   IPM to inform black duck AHM (*Pat Devers*)

The international Black Duck Harvest Strategy uses an integrated population model (IPM, Figure 1) with a state-space formulation to estimate population vital rates and abundance over time. The black duck IPM uses breeding abundance data (BPOP), band encounter data, and parts collection data. The IPM consists of 2 sub-models, one that describes recruitment of juvenile birds into the fall flight (represented as the fall age ratio $[AR]$) and one that describes annual survival. The recruitment sub-model describes recruitment as a function an intercept ($c0$), black duck density dependence ($c1$), mallard competition ($c2$), and a time trend ($c3$):

$$AR_t = e^{(c0 - c1 \times BD_t - c2 \times MALL_t - c3 \times t)},$$

where AR is the fall age ratio, BD is black duck population abundance, $MALL$ is mallard population abundance; and t is year. The survival sub-model describes annual survival (fall - fall) as:

$$logit(S_t^{age,sex}) = a0^{age,sex} + (a1 \times h_t^{age,sex}),$$

where (h) is the cohort-specific harvest rate in year (t), $a0$ is annual survival in the absence of harvest, and $a1$ is an estimate of the effect of harvest mortality on annual survival. When $a1 = 0$ harvest mortality is completely compensatory, when $0 < a1 < 1$ harvest mortality is partially compensated, and values of $a1 > 1$ indicate additive mortality (Figure 2). Harvest rate (h) is estimated using direct recoveries (i.e., birds shot or found dead in subsequent hunting season). It is important to note that because the additive effect of harvest is on the logit scale the response is nonlinear (Fig. 3) as in Anderson and Burnham (1976).

Unlike mid-continent and eastern mallard adaptive harvest frameworks which contrast the performance of competing discrete models, the BDAHM framework uses a parametric uncertainty approach. Under this framework, one model that includes the effect of harvest on annual survival and mallard competition is used to predict population growth. Uncertainty in the effect these factors have on population dynamics is
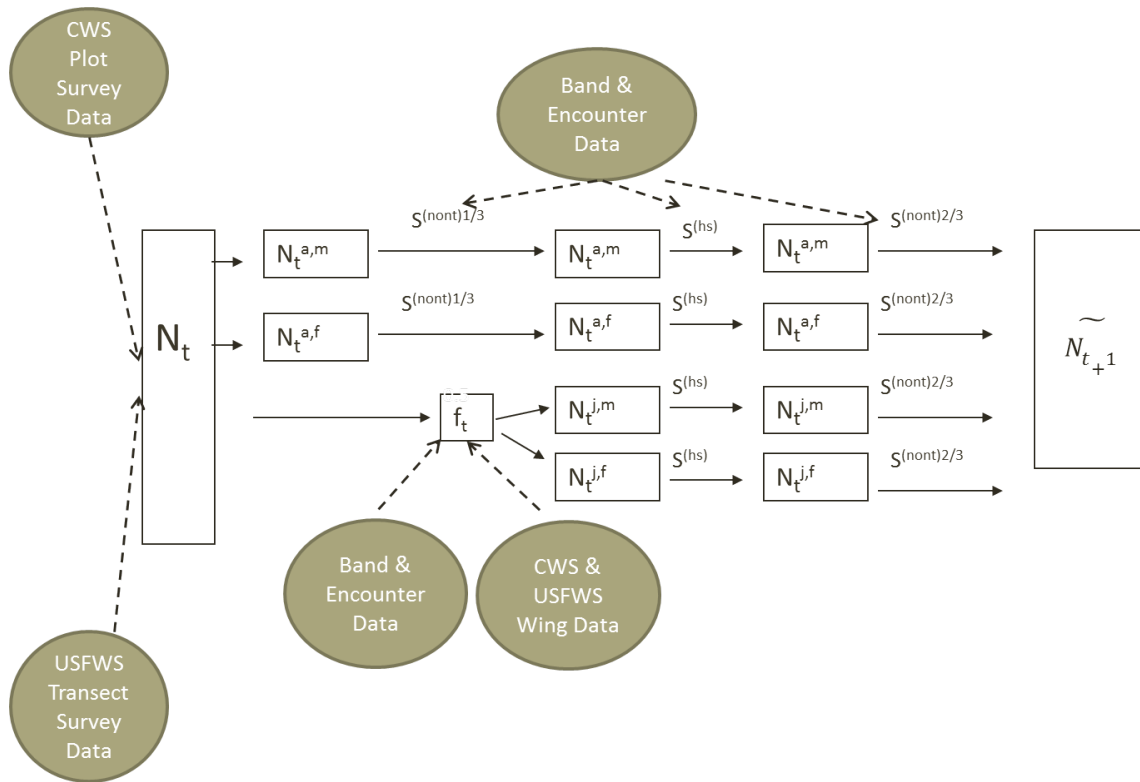
Figure 1 – Demographic flow diagram and data sources used in the black duck integrated population model.
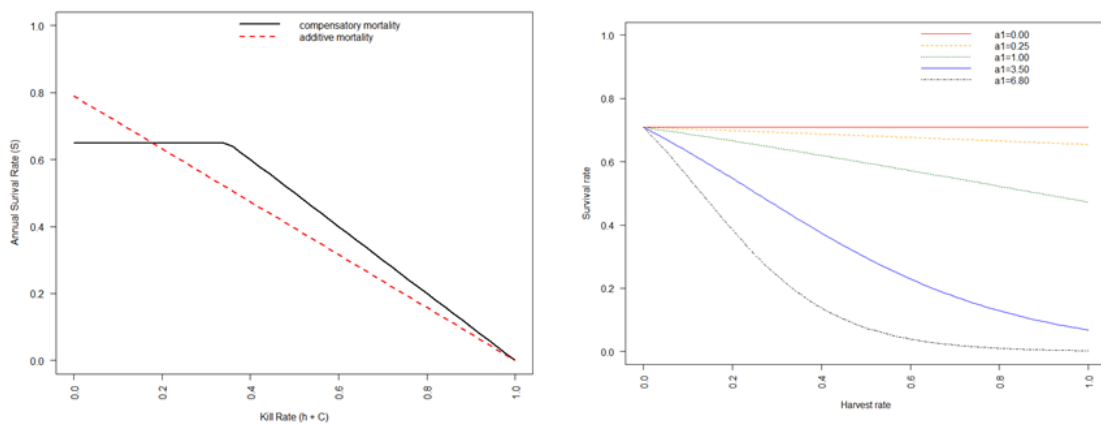
Figure 2 – Functional forms modeling survival as a function of harvest rate (kill rate) under the hypothesis of additivity and compensation as described by (Anderson and Burnham 1976); left and (Conroy 2010); right.
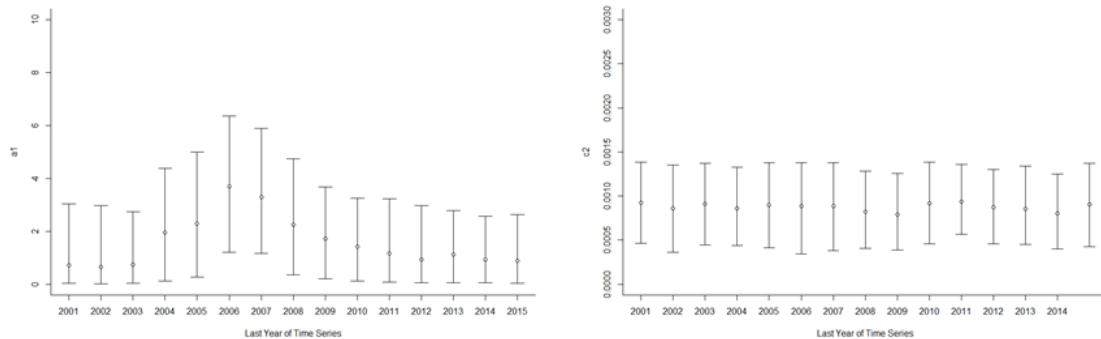
Figure 3 – Estimated values of harvest additivity ($a1$, left) and mallard competition ($c2$, right) estimated with the Black Duck integrated population model.

represented by the resulting posterior distributions of each parameter. In essence, the parametric approach contrasts a large number of competing models by representing various levels of additivity and competition based on the uncertainty in estimates of the beta coefficients $a1$ and $c2$. Learning is achieved by updating data streams (i.e., BPOP, banding, encounter, etc.) annually and re-estimating model parameters (Figure 3). Annual harvest regulations are derived using the estimated population vital rates, $a1$ and $c2$, and country-specific harvest packages in an optimization routine. Annual regulations depend on the uncertainty associated with the parameter estimates, particularly $a1$ and $c2$ represented through posterior distributions.

8.4   IPM to model and estimate wood duck population dynamics (*Guthrie Zimmerman*)

The U.S. Fish and Wildlife Service and the Atlantic Flyway are cooperatively developing a framework to set annual waterfowl harvest regulations that is based on multiple duck species (i.e., multi stock). The wood duck is an important component of the multi stock framework because it is one of the most harvested species throughout the entire flyway. Including wood ducks in a multi stock framework requires a robust monitoring program to adequately document population dynamics for the species throughout the flyway. However, wood ducks are difficult to survey at large spatial scales (e.g., an entire flyway) using methods commonly employed for large scale surveys (e.g., counts from aircraft) because of their affinity for forested habitats. The Breeding Bird Survey (BBS) provides an index (birds per route) to wood duck abundance throughout the entire flyway, but provides no means for extrapolating this index to a population estimates. States in the northern half of the Atlantic Flyway have conducted ground plot surveys since 1993 (AFBWS) that can be used to estimate actual population size in that region, but surveys exclude Maine and states from North Carolina south to Florida. We developed an integrated model that combines data from the BBS and AFBWS to derive an Atlantic Flyway-wide population size estimate for wood ducks. We used the ratio of population indices where the two surveys overlap to develop a scaling parameter that can scale BBS indices in regions without AFBWS to a population size estimate. To improve the robustness of this model, we built on it by including demographic and harvest data to develop a fully integrated population model for wood ducks in the Atlantic Flyway that included BBS, AFBWS, survival, recruitment, and harvest data. The full IPM for wood ducks yielded a flyway-wide wood duck population of 0.99 million, which was similar to the estimate based solely on the BBS and AFBWS data (1.01 million). The full IPM appeared to corroborate earlier population estimates and trends, but also allowed us to derive estimates of parameters that we had no data to directly estimate (i.e., sex ratio of the breeding population and summer survival rates).

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9 Updating HMWG priority actions and work plan

The Working Group reviewed progress on the 2016 priority action items and opened up a discussion to identify the highest priority technical work for 2017. The continued work focusing on revising the AHM frameworks that govern each Flyway's season frameworks was identified as the highest priority for technical work in 2017. The scope of this work was then compared to other high priority rankings discussed at the HMWG meeting and a new priority list was developed for review by the SRC and the Flyway Councils in preparation for discussions during the 2017 regulations cycle (see attached Priorities). The HMWG noted that additional work items that the Service or the Flyways would like to see addressed that are not included in these actions would necessarily delay completion of the highest priority tasks.

9.1 2017 HMWG Meeting

The 2017 HMWG meeting will be hosted by the Pacific Flyway during the week of 4 – 8 December 2017.

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Harvest Management Working Group
2016 Meeting Agenda
Amarillo, Texas

Monday 5 December 2016

      Travel day

1300   Mid-continent mallard double-looping technical team meeting (MF, CF, PHAB)

Tuesday 6 December 2016

0800   Welcome, introductions, logistics, agenda (Case, Boomer, and Kraai)

0830   Flyway reports

      Atlantic, Mississippi, Central, Pacific (State Technical Representatives)

      US Fish and Wildlife Service (Flyway Representatives)

      Canadian Wildlife Service (Roy)

      US Fish and Wildlife Service DMBM (TBD)

      Communication team updates (Kelley)

1000   BREAK

1030   2018 regulation cycle, sea ducks, reward banding, canvasbacks

1100   New Business Review of the Waterfowl Breeding Populations and Habitat Survey (Roy)

1200   Lunch

1300   Partner updates

      IIC-PET work plan (Case)

      Human Dimensions Working Group (Vrtiska)

      National Science Support Team (Devers)

      Hunter Retention, Recruitment, Reactivation Workshop results (Raedeke, Case)

1500   BREAK

1530   DMBM priorities/ administration transition (Dubovsky)

      AHM resiliency and institutional support (Boomer)

      Round Robin Discussion: Relevancy of waterfowl harvest management

1700   Adjourn

Wednesday 7 December 2016

0800   2017 regulations cycle recap and outstanding issues

0830   Mid-continent mallard AHM revision

      Progress report

1000   BREAK

1030   Eastern mallard AHM revisions

      Progress report

1200   LUNCH

1300   Pacific Flyway AHM issues

1400   Group Discussion: What happens with pintails, scaup, and canvasbacks

1500   BREAK

1530   Multiple Criteria Decision Making: methods and application (Runge)

1630   Group Discussion: scope of decision analyses to establish AHM frameworks

1700   Adjourn

Thursday 8 December 2016

0800	Meeting recap (Case)
0830	Integrated population models (IPM) and AHM
	IPMs as a basis for harvest management (Boomer)
	IPM to evaluate factors affecting mid-continent mallard recruitment and survival (Zhao and Boomer)
1000	BREAK
1030	IPM to inform black duck AHM (Devers)
	IPM to model northern pintail meta-population dynamics (Osnas et al)
	IPM to model and estimate wood duck population dynamics (Zimmerman et al)
1200	LUNCH
1300	Plans for 2017: Action items, Priorities for 2017-18, Task assignments
	Next meeting: location (Pacific Flyway), date, topics
1500	BREAK
1530	Meeting summary and parting thoughts (Case)
1600	Adjourn

Friday 9 December 2016

Travel Day

2018 Harvest Management Working Group Priorities

Priority rankings and project leads identified for the technical work proposed at the 2016 Harvest Management Working Group meeting.

Highest Priorities (Urgent and Important)

- Adaptive Harvest Management Revisions (*aka, Double-looping*)
  - · Multi-stock management (*Atlantic Flyway, PHAB, HMWG*)
  - · Mid-continent mallard (*Mississippi and Central Flyways, PHAB, others...*)
  - · Western mallard (*Pacific Flyway, PHAB, others...*)
- Re-invigorate institutional support for AHM (*PHAB, and HMWG Communications Team*)

Long-range Priorities (Non-urgent, but Very Important)

- Time dependent optimal solutions to address system change (*Scott Boomer, Fred Johnson, Mike Runge*)
  - · Habitat change
  - · Hunter dynamics
  - · Climate change
- Northern pintail AHM Revision (Double-looping) (*Pacific Flyway, PHAB, others...*)
- Consideration of NAWMP objectives for waterfowl management (*HDWG, Flyway Councils, FWS, NAWMP Interim Integration Committee, Joint Technical Committee, others...*)

Additional Priorities

- Waterfowl harvest potential assessment methods case study development (*PHAB, Tech Sections, others...*)
- Canvasback harvest strategy development (*PHAB, Tech Sections, others...*)
- Waterfowl Breeding Population and Habitat Survey Review (*Migratory Bird Surveys Branch, HMWG*)

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This list includes only permanent members of the Harvest Management Working Group. Not listed here are numerous persons from federal and state agencies that assist the Working Group on an ad-hoc basis.

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Sean Kelly	Region 3 Bird Chief (Designee)	U.S. Fish & Wildlife Service
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Other Participants		
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Figure 4 – The participants of the 2016 Harvest Management Working Group meeting in Amarillo, TX.